A WALL PANEL AND WALL STRUCTURE

FIELD OF THE INVENTION

The present invention relates to a lightweight concrete panel for use as an outer layer of a dwelling wall and a dwelling wall comprising such a lightweight concrete panel.

BACKGROUND

In Australia many conventional dwellings have brick veneer walls that typically comprise a structural frame having an outer layer of bricks and an inner layer of plasterboard liner. In recent years such walls have been constructed with insulation foil disposed therein. The use of the insulation foil increases the thermal resistance of the dwelling wall and results in a far more energy efficient home. Whilst many home builders and the general public at large are becoming more aware of the advantages of energy efficient homes, their cost of construction are still quite considerable, particularly due to the labour and materials handling required.

The present invention seeks to provide a lightweight concrete panel that can be used in the construction of a dwelling wall that has a thermal resistance greater than that of a brick veneer wall, and is relatively simple to construct.

SUMMARY OF INVENTION

According to a first aspect the present invention consists in a lightweight concrete panel for use as an outer layer of a dwelling wall, said panel made of concrete mix of cement, sand, BST lightweight concrete aggregate, superplasticiser and water, said concrete mix having a nominal density in the range of 500 to 1500kg/m^3.

Preferably said superplasticiser proportion comprises of 0.5-1.5 % of cement by weight.

Preferably said water/cement ratio is 0.30– 0.35 by weight of cement.

Preferably said panel has a backing sheet of polystyrene affixed thereto.

Preferably said lightweight concrete panel is about 50mm thick and said polystyrene backing sheet adhered thereto is about 10mm thick.

Preferably said panel has at least a first edge having a groove and at least a second edge having a tongue, such that it can be engaged in a tongue and groove relationship with one or more like panels.

According to a second aspect the present invention consists in a dwelling wall comprising a structural frame of spaced apart studs and noggings disposed between an outer layer of lightweight concrete panels and an inner layer of plasterboard liner, and wherein said lightweight concrete panels are made of a concrete mix having a nominal density in the range of 500 to 1500kg/m^3.

Preferably said lightweight concrete panels are made of a concrete mix of cement, sand, BST Aggregate, superplasticiser and water.

Preferably the proportion of said superplasticiser comprises of 0.5-1.5 % of cement by weight.

Preferably said water/cement ratio is 0.30– 0.35 by weight of cement.

Preferably at least one of said lightweight concrete panels having a polystyrene backing sheet affixed thereto.

Preferably said at least one of said lightweight concrete panels is about 50mm thick and said polystyrene backing sheet is adhered thereto is about 10mm thick.

Preferably said at least one of said lightweight concrete panels has at least a first edge having a groove and at least a second edge having a tongue, such it can be engaged in a tongue and groove relationship with one or more like panels.

Preferably a panel clip is secured to said structural frame and adapted to engage with said at least one of said lightweight concrete panels and an adjacent like panel at the junction of their respective tongue and groove relationship.

Preferably at least one first foil member is disposed within said structural frame between said spaced apart studs and noggings.

Preferably said first foil member is a concertina foil batt.

Preferably at least one second foil member is disposed between said layer of lightweight concrete panels and said structural frame.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an perspective cut-away corner view of an embodiment of a dwelling wall in accordance with the present invention.

Fig. 2 is a plan sectional view of the dwelling wall shown in Fig. 1.

Fig. 3 is a perspective view of a standard lightweight concrete panel used in the construction of the dwelling wall shown in Fig 1;

Figs. 4a and 4b depict perspective views of corner lightweight concrete panels used in the construction of the dwelling wall shown in Fig 1;

Fig.5 is a perspective view of a panel clip used in the construction of the dwelling wall shown in Fig 1.

MODE OF CARRYING OUT INVENTION

Figures 1 and 2 illustrate, in a simplified schematic figure, the construction of a dwelling wall 1 having a structural frame comprising of wooden studs 2 and noggings 3. In this embodiment the studs 2 and noggings 3 are preferably 100 x 50 pine, but in other embodiments may be of different size, timber or material.

The inner layer of dwelling wall 1 comprises of conventional plasterboard liner 4, which is typically about 13mm thick, attached to the structural frame of studs 2 and noggings 3.

The outer layer of dwelling wall 1 comprises of a plurality of lightweight concrete panels 5a, 5b, 5c, 5d and 5e. Each standard panel 5a and corner panel 5b is about 600mm x 300mm x 60mm, whilst smaller corner panel 5c is about 300mm x 300mm x 60mm.

All panels 5a-c have a tongue 6a along their upper horizontal extent and a groove 7a extending along their lower horizontal extent, for horizontal stacked engagement in tongue and groove relationship with other like panels 5a-c. The standard panels 5a also have a tongue 6b and groove 7b disposed oppositely to each other along their vertical edges, for vertical abutment in tongue and groove relationship with other like panels 5a-c.

The corner panels 5b and 5c vary on the vertical edges, in that the groove 7b is replaced by a flat face 7c. It should be noted that in Figs 4a and 4b the corner panels shown are for starting at left

and travelling right, however, corner panels starting at right and travelling left 5d and 5e, vary from panel 5a by replacing the tongue 6b by a flat face.

Panel clips 8 secured to studs 2 at 450-600mm spacing by nail or screw fasteners, are used to secure panels 5a-c to the structural frame. Each panel clip 8 has a back portion 9 adapted to sit flush against the stud 2 to which it is secured. The ledge portion 10 which projects from back portion 9, is adapted to engage with adjacent lightweight concrete panels 5a-c at the junction of their substantially horizontal respective tongue 6a and groove 7a.

Concertina (or zig-zag) foil batts 11 are disposed within the structural frame between the inner layer of plasterboard liner 4 and outer layer lightweight concrete panels 5a-e. One suitable type of batt 11 is the commercially available Renfoil aluminium concertina batt.

Also a second layer of foil sheet 12, as shown in Fig. 2, but removed for purposes of clarity from Fig. 1, is attached to the studs 2 of the structural frame, preferably dished a minimum of 25mm. A suitable type of foil sheet 12 is the commercially available Renfoil aluminium foil sheet.

The lower portion of wall 1 has an apron 14 which extends downwardly from a 100 x 75 HWD plate 15. The apron 14 does not extend to the ground line. A mesh 17, preferably of stainless steel covers the gap between apron 14 and the ground, and is affixed to pine fixing plate 18. Flashing 16 is placed between the bottom row of panels and plate 15.

The lightweight concrete panels 5a-c are manufactured by moulding and in this embodiment are preferably moulded to a thickness of about 50mm. Once the panels are moulded they each have a polystyrene sheet 13 of about 8-12mm adhered to their back. The panels are then cured in racks. The resulting thickness of the panels in this embodiment is about 60mm. In an alternative embodiment, the polystyrene sheet 13 may be affixed to the panel during moulding/casting.

The concrete mix used to make the panels 5a-c is extremely lightweight. Generally speaking, "lightweight" is typically regarded as low-density concrete of less than 2100 kg/m^3 using lightweight aggregate (scoria) or BST (Polystyrene Beads).

In the present invention the concrete mix used to make the panels has a density substantially less than 2100 kg/m^3 and preferably in the range of 500-1500 kg/m^3. More preferably the density of the concrete mix is in the range 700-1200 kg/m^3. The concrete mix comprises cement, sand, BST lightweight concrete aggregate, a high range superplasticiser and water.

Examples of suitable mixes are shown in the table below.

Nominal Density	1200 kg/m^3	800 kg/m^3	700 kg/m^3
Materials			
Type GP Cement	40kg	40kg	40kg
Fine sand	55kg	24kg	20kg
BST lightweight concrete aggregate	70 litres	110 litres	120 litres
Superplasticiser	295ml	295ml	295ml
Water	13.0 litres	13.0 litres	13.0 litres

Whilst in the abovementioned examples the cement used is General Purpose Cement (Type GP), other types of cement such as High Early Strength Cement (Type HE), or blended cements including slag or fly ash blends may be used.

In the abovementioned examples the sand weights are measured as "saturated, surface dry".

In the abovementioned examples the proportion of superplasticiser is 0.8% of cement by weight, but may vary from 0.5% to 1.5%. The preferred proportion of 0.8% is based on using the commercially available Sika ViscoCrete® –5 superplasticiser. In other embodiments other brands of superplasticiser may be used.

In the abovementioned examples water quantity is designed to achieve a water/cement ratio in the range of 0.30 –0.35 by weight of cement. This low water/cement ratio is used to optimise concrete strengths and to suit compaction of the concrete.

An advantage of constructing a dwelling wall utilising lightweight concrete panels as described above, is that the wall will have a thermal resistance at least twice that of a conventional brick veneer wall incorporating foil insulation, thereby making the dwelling more energy efficient. A further advantage of the dwelling wall utilising such lightweight concrete panels is that its weight/mass is considerably less than a brick veneer wall and may be constructed faster and with less skilled labour than a brick veneer wall, thereby reducing the overall cost for constructing the dwelling.

A further advantage is that the concrete panels as described above have suitable aesthetic appeal and look somewhat like a sandstone finish.

The term "comprising" and its grammatical variations as used herein is used in the inclusive sense of "having" or "including" and not in the exhaustive sense of "consisting of".